Collocation of Five Elements of Opposing Ionization States in a Semi-Molten Mixture Within a Strong Magnetic Field as Starting Point for Self-Assembly of Maximal Strength Alloy

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Introduction

Emerging materials science, mostly surrounding layer-deposition manufacturing, is showing that five-element alloy composition provides superior strength compared to alloys of fewer than five metals, and there has been some speculation that adding more and more metals beyond a number of five will perhaps increase strength further.

Abstract

I propose that it should be regarded as general maxim in materials science that in most cases, five is the ideal number of elements for maximizing strength in an alloy.

The reasons for this are quite straightforward and are important to understand before I start in on the central topic, which is the specific method for creating maximal strength alloys well beyond current record-holding alloys and doing so using a novel method that has nothing to do with layer-deposition manufacturing or "3-D Printing," if you will.

The first of two primary reasons for the five-component alloy being strongest has to do with how many primary directions in which any object may be arrayed with relation to a central point without pushing one another out of the way when all said objects are roughly the same size. These directions are up/down, left/right, fore/aft, and in four diagonal directions in three dimensional space from any given starting point. Furthermore, in an ideal alloy, like elements never directly border one another.

If we structure an alloy so that each starting point has one atom of the same element behind it and in front of it, one atom of yet another element above it and below it, one atom of a 4th unique element to the left and right of it, and in the four diagonal directions, a 5th unique element of which there are four total atoms in each alloy cluster, that will give us 11 total atoms in each cluster. Our ideal cluster, especially given the method I intend to propose, will be composed of five elements, each of which are strong on their own and each of which have different valence electron counts in their natural state; one, two, three, four, and five, respectively.

The second primary reason for five being a sort of 'magic number' in this case is that the strongest elements used in alloy-making tend to have between one and five valence electrons. Elements with six to eight valence electrons are generally not suitable for construction and given that we want to maximize ionic convection and material defect generation, using more than one element with the same valence count would render the system ineffective.

For the purposes of our example, we'll make the central atom copper with its single valence electron, manganese above and below (2 valence,) aluminium to the left and right (3 valence,) carbons in the fore and aft directions (4 valence,) and bismuth in the diagonal directions (5 valence.) This would make our ideal alloy 9.09% copper, 18.18% manganese, 18.18% aluminium, 18.18% carbon, and 36.36% bismuth.

Thus, our initial cluster consists of 11 atoms and could be neither termed a cube nor a sphere. By repeating this pattern and rotating it gradually and with an inter-networking of clusters of this composition forming a mesh, a structure may be created that is mostly empty space and thus is comparatively lightweight.

Layer-deposition methods are lacking when it comes to generating nanoscopic alloy features such as defect-insertions intended to make the overall structure stronger.

To construct the proposed alloy in the proposed configuration, the elements will need to be in a semi-molten state wherein atoms are free to move around and mixed evenly in a liquid solution. Furthermore, before being admixed, the manganese would be bestowed with a strong negative charge, the copper left neutral, and the other three made to be electrically positive with as many electrons stripped away as possible. A magnetic field of substantial intensity would be used to help to maintain the ionic disequilibrium between the different elemental components. The semi-molten amalgam would be allowed to solidify but while still glowing-hot, the powerful magnetic field preventing the flow of electrons between anions and cations would be abruptly suspended.

This approach will generate strongly-bound fibers of alloyed element clusters with unique characteristics brought on by the sudden shift from mutual attraction to asymmetrical ionic convection and shearing of the component elements within a partially solidified red-hot amalgam. As electrons in the anionized manganese suddenly begin flowing toward cations, the total lack of a magnetic field causes the individual atoms to begin to randomly vary their orientation; another historical attribute of strong alloys. While the formerly cationized elements would begin to "move off" as they no longer have like charges, as long as electrons are flowing, a countervailing force is pushing back against that osmotic force.

The result of this is that not only will all five elements combine within the same strands, but distortions in the strands will form as a result of the torsional forces associated with the competing attractive and repulsive forces. These ripple-like defects would massively increase the strength of the fibers.

The open question is: How powerful of a magnetic field would be required to prevent electron flow in amalgamated liquid metals and how practical it would be to manufacture alloys on this basis?

One possibility to reduce cost would be to combine the principles of layer-deposition manufacturing with this approach, utilizing highly focused,

microscopic magnetic fields to achieve the effect on a small scale in an economical way.

This alloy should be self-assembling provided that it is possible to merge liquid metals with radically different electrical charges while temporarily restricting the flow of electrons between them regardless of innate conductivity and allow for charge equalization to occur under the aforementioned controlled conditions.

Conclusion

This class of materials may do for buildings what carbon fiber did for sports cars, reducing the weight of components while actually increasing strength.